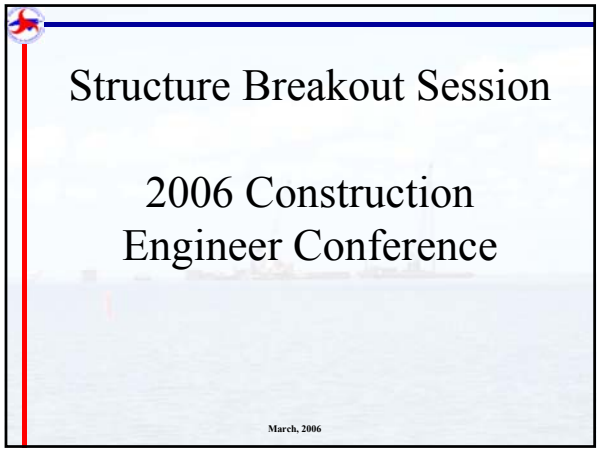
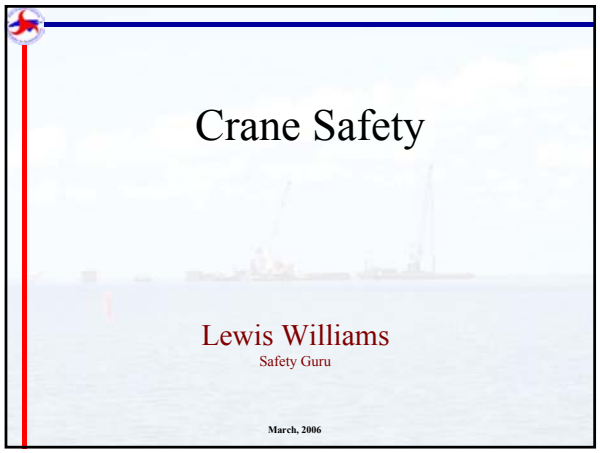

Structure Breakout Session
2006 Construction Engineer Conference
March, 2006


Crane Safety
Lewis Williams
Safety Guru
March, 2006


March, 2006

Structures Breakout

Special Provision

- NC DOT policy effective date
  - July 2006
- Critical Lifts
- Operator Certification
- Competent Person
- Inspections
- Qualified Rigger

Critical lift Definition

- CFR 1926.751
- (1) exceeds 75 percent of rated crane capacity.
- or
- (2) requires the use of more than one crane.

Rated Crane Capacity

- A cranes rated capacity is NOT as simple as 50 ton crane lifting 37.5 tons.
- A 50 ton Link Belt crane with a 100 foot of boom lifting
- 8 ton beam at a radius of 40 feet
- 70% of rated capacity.

Structures Breakout

Crane Operator Certification

- crane operators performing critical lifts shall be certified by NC CCO (National Commission for the Certification of Crane Operators)

OR

- Satisfactorily complete the Carolinas AGC's Professional Crane Operator's Proficiency Program. Other approved nationally accredited programs will be considered upon request. All crane operators shall also have a current CDL medical card.
- Operator certification for the type of crane operated (small hydraulic, large hydraulic, small lattice, large lattice) and medical evaluations for each.

Inspections

- Inspection records for all cranes shall be current and readily accessible for review upon request.
  - Frequent
    - » Written Visual
    - » daily to monthly (30 day)
    - » Post assembly of lattice boom
  - Periodic---
    - » Tear down
    - » Monthly to Yearly

Power Line Clearances

•0-50 kV	10 feet	Distribution
•50-200 kV	15 feet	Transmission
•200-350 kV	20 feet	Overland Transmission

Competent Person

- Responsible for crane safety and lifting operations.
  - Certified Operator
  - Contract Engineer
- The competent person will have the responsibility and authority to stop any work activity due to safety concerns.

Qualified Rigger

- Qualifications and experience should include, but not be limited to, weight calculations, center of gravity determinations, selection and inspection of sling and rigging equipment, and safe rigging practices.

Structure Types and Construction Access Issues

Ron Hancock
State Bridge Construction Engineer

March, 2006

Structures Breakout

NCDOT # of Bridges

13,293

Number of Bridges Constructed per year

150

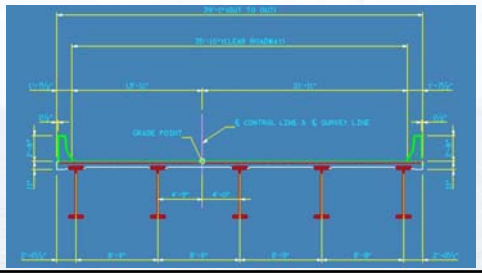
Steel Girders

30% of NCDOT bridges use steel plate girders with weathering steel

Structures Breakout

Steel Superstructure

- Long Spans
- Flexibility on Superstructure Depth
- Curved Girders

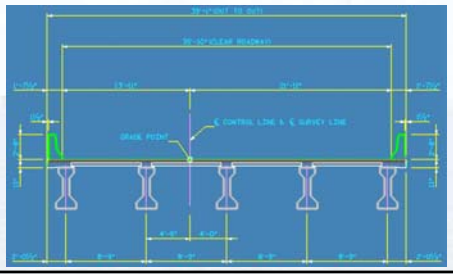


Prestressed Concrete

70% of NCDOT bridges use prestress concrete superstructures

Concrete Superstructure

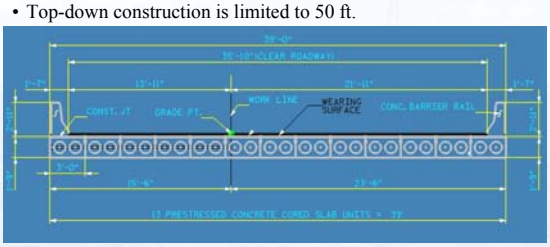
- Standardized Girder Sections
- Durability
- Corrosive Environments



Structures Breakout

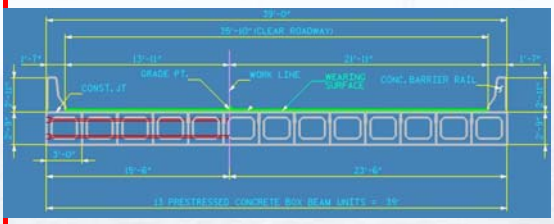
Cored Slabs

- Maximum Span Length - 60 ft.
- Shallow superstructure depth
- Can be constructed using top-down construction
- Top-down construction is limited to 50 ft.



Box Beams

- Benefits similar to cored slab bridges
- Maximum Span Length 100 ft.
- May allow use of single span and elimination of costly foundations



Typical Span Ranges

Material	Girder Type	Span Range
Steel	I - Girder	90' – 300+'
Prestressed Concrete	I - Girder	40' – 130'
	Box Beam	60' – 100'
	Cored Slab	20' – 60'

Structures Breakout

Constructibility

- ***Access Issues***

Causeway

Workbridge

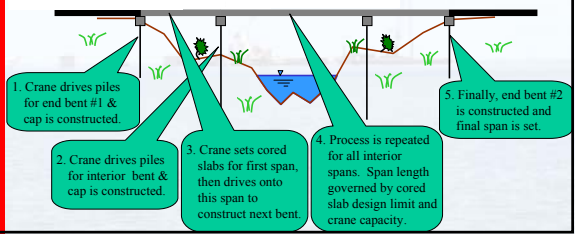
Floating

- ***Causeway***

- ***Workbridge***

• *Barge Access*

Top-Down Construction



Top-Down Construction

Structures Breakout

Joints on Cored Slab Bridges
with
Asphalt Overlay

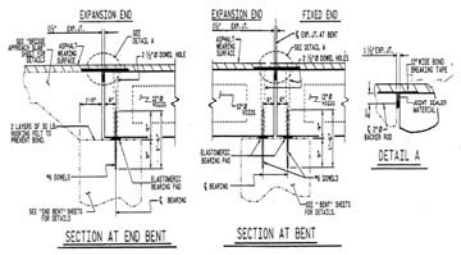
Lee Puckett
Engineer's Construction Conference 2006

Introduction

Construction problems with cored slab structures at the joints when Asphalt overlays are utilized.

Topics of Discussion

Old Design vs. **New** Design



Old Design

Old Design Method Of Construction

Expansion dowel holes are filled 1/2 full with joint sealant material and completed with grout.

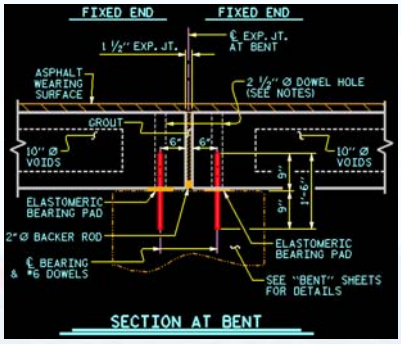
Backer rod material is placed approx. 2" from top of cored slab and joint sealant material placed from backer rod to top of slab unit.

Bond breaking material placed over joint prior to asphalt paving

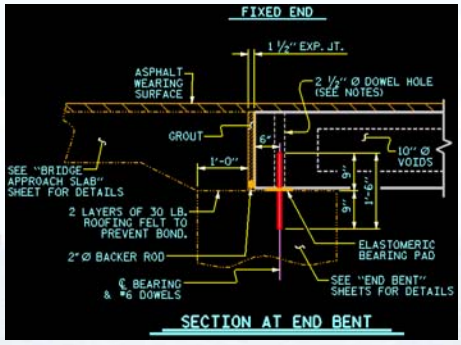
Old Design with Backer Rod and Joint Material

Structures Breakout

Utilizing OLD design, cracking measured approx. 3/4”



New Design



New Design

New Design Method of Construction

All dowel holes(expansion and fixed) are to be completely filled with grout.

Backer rod is to be placed at the **BOTTOM** of the joint and the joint is to be filled to the top of the slab with grout material. This is at **ALL** joints.

Placement of bond breaking material has been eliminated.

Application of New Design

Cored slab bridges of any length, which are detailed with an asphalt overlay.

Cored slab bridges up to 150' in length, which are detailed with a concrete overlay.

Existing projects with an "OLD" design should be **revised** to "NEW" design. Questions pertaining to this should be directed to your Bridge Const. Engineer.

New detail with minimal cracking

Summary

With the **new** design, cracking is still expected to occur. However, we anticipate this cracking to be minimal.

Questions?????

Questions?

March, 2006

Box Beams

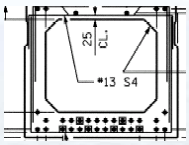
Cameron Cochran
Bridge Construction Engineer
Divisions 11, 13 & 14

March, 2006

What is a Box Beam??

Box Beams

Box Beam ≠ Cored Slab



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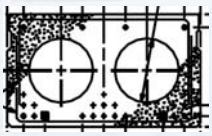
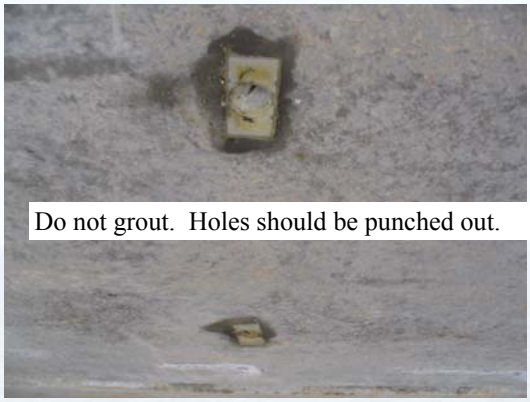


Differences

	Cored Slab	Box Beam
Strand Size	.5”	.6”
Strands Per Diaphram	1	2
Tension	30,000#	43,950#
Max. Length	≈60’	≈100’

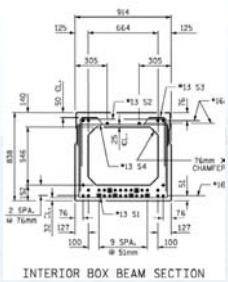
Limitations

- Skew must be between 60 and 120 degrees
- grades must be 4% or less
- Cap slope must be 2% or less



Do not grout. Holes should be punched out.

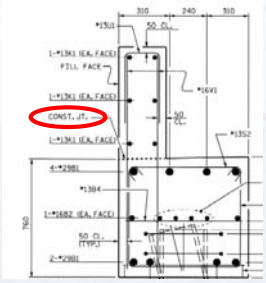
Innards of a Box Beam



Structures Breakout

Innards of a Box Beam

Backwall



Reinforced approach fill

Inset 'B'

Height of Backwall	Number of Fabric Layers
1400-1750	3
1760-2200	4
2210-2650	5
2660-3100	6
3110-3550	7

Note: Cored Slab Structures Require 2 Fabric Layers.

Tensioning

Tension the bars or strands in the diaphragm nearest mid-span first. Proceed to tension bars or strands in the adjacent diaphragms. Continue the tensioning operation in a symmetric manner along the length of the span. At each diaphragm location, maintain a symmetric tension force between each pair of bars or strands in the diaphragm.

Tensioning

PSI ≠ Pounds

Gauges read in PSI. This must be converted to pounds. Jacks should have a table showing the relationship of the dial reading to actual pounds of tension.

Structures Breakout

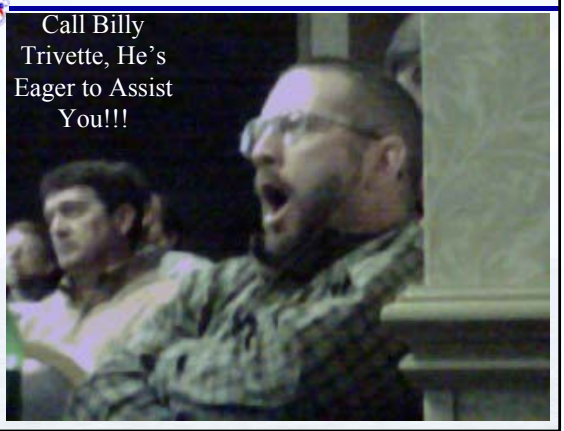
Grading sidewalks and rails

- If sidewalks are on the box beams they need to be variable height. This allows rail to be constant height.
- If only rail is called for, the bottom of the rail should be variable height.
- Contractor should get centerline and gutterline elevations.

Problems

- Barrier rail steel too high
- Irregularities magnified

Call Billy Trivette, He's Eager to Assist You!!!



Reinforced Concrete Deck Overlays For Cored Slab & Box Beam Bridges

By:
Rick Nelson
Bridge Construction Engineer Div. 1 & 5

Why Overlay with Concrete?

- Use Cored Slab/Box Beam bridges in locations where Steel/Concrete Girder previously required
- Better live load distribution than Asphalt
- Enables installation of a true joint system
- Reduce slab deterioration due to saturation by water
- Reduce maintenance exposure

March, 2006

Disadvantages?

- High initial cost compared to asphalt
- Proper deck prep critical to success
- More time to construct than asphalt overlay

Structures Breakout

Overlay Special Provision

- Slabs shall have a raked finish (not broomed)
- Sandblast/Pressure wash thoroughly prior to overlay
- Soak & cover surface for 12 hrs prior to placing overlay
- Rebar will typically be #3 Bars @ 6" O.C. each way
- Use Class AA Concrete w/ 78M aggregate & Fly Ash

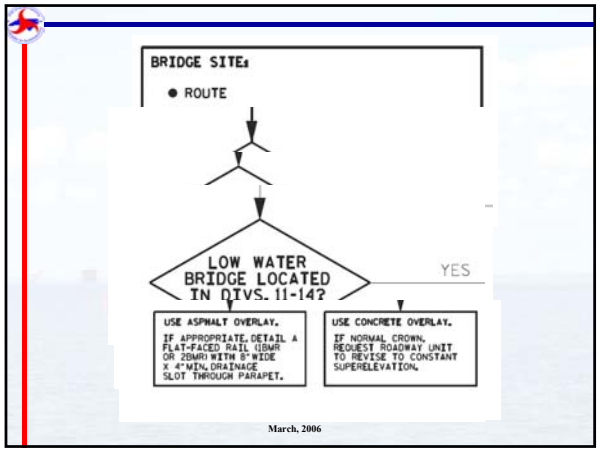
Grading the Deck for the Overlay

- Will not have a deflection table.
- Grade deck off profile grade line.
- Check minimum deck thickness at midspan.
- Compare to profile grade.
- Adjust fills as needed to achieve desired final grade

Is there a project selection process?

- "Why did you put that on a dead end road with 2 houses?"

Structures Breakout



Structures Breakout

Structures Breakout

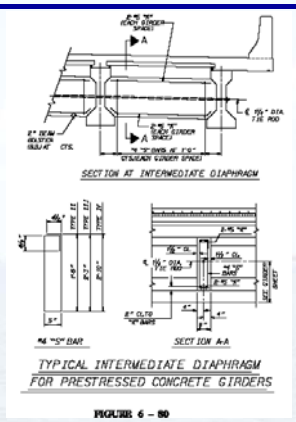
Intermediate Diaphragms

Old way

New way

Intermediate Diaphragms

The Way We Have Always Done It



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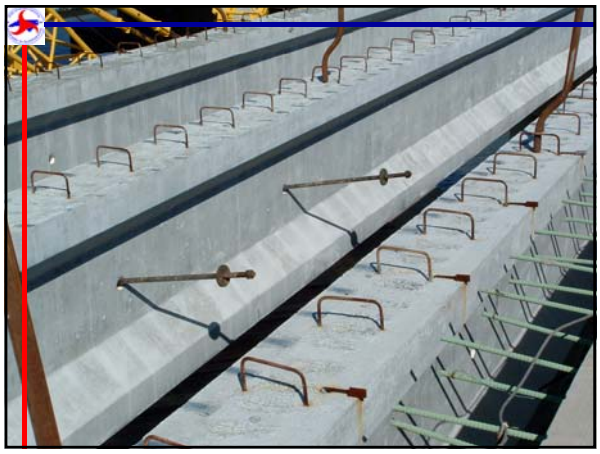

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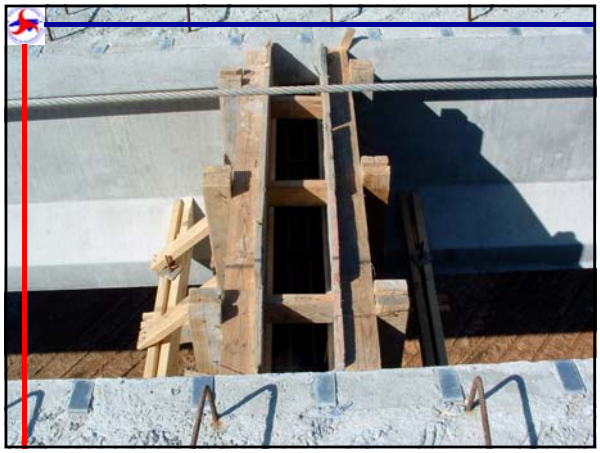


Structures Breakout

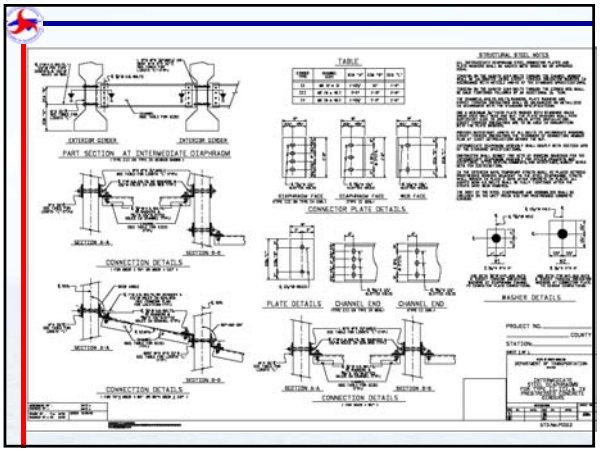
BOTTOM LINE….

FORM & POUR - 3 DIAPHRAGMS / DAY
WAIT...WAIT...WAIT FOR CURE / STRENGTH
WRECK FORMS, ETC.

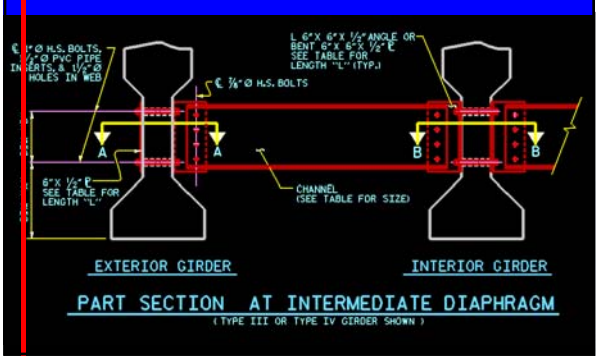
10 DAYS FOR TYPICAL
3 SPAN / 4 GIRDER BRIDGE

Intermediate Diaphragms

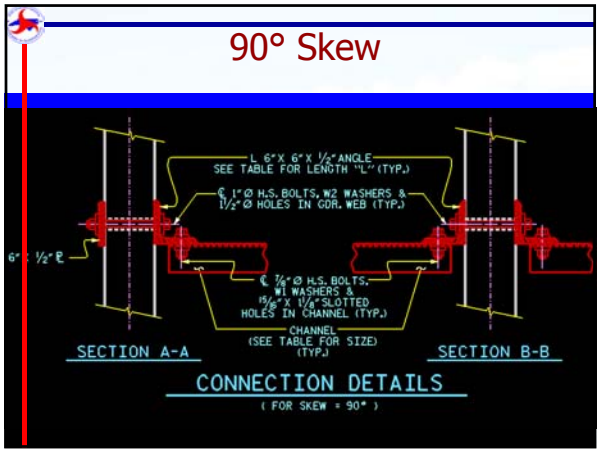
New & Improved

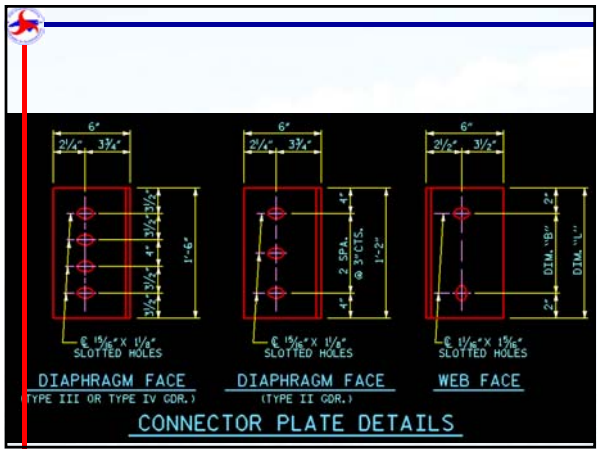


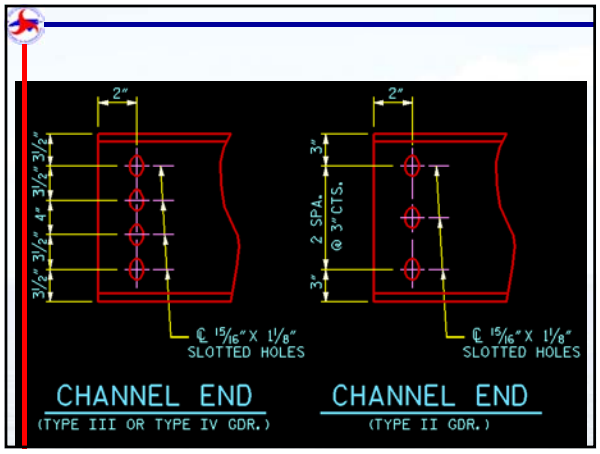
Diaphragm Section



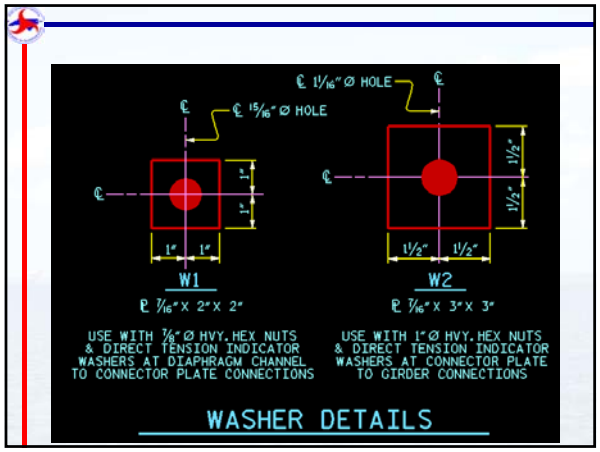
Structures Breakout







Structures Breakout



Structures Breakout

BOTTOM LINE….

ERECT - 9 DIAPHRAGMS / DAY
GO HOME

1 DAY FOR TYPICAL
3 SPAN / 4 GIRDER BRIDGE

COMPARISON SUMMARY

(2 paired - 3 span structures)

	CIP Concrete	Steel
Materials	$ 11,250	$ 19,950
Install	$ 12,900	$ 2,950
Total	$ 24,150	$ 22,900
Time	40 days	4 days ★

Questions?

Standard Overhang Falsework

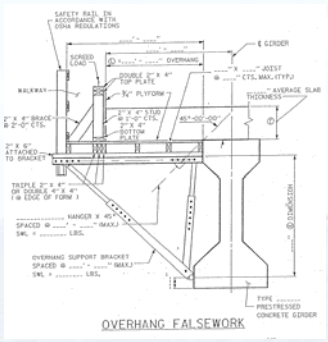
Michael Robinson
Bridge Construction Engineer
Divisions 2,3,and 4

March, 2006

Hangover!

When is an overhang falsework submittal required?

March, 2006



March, 2006

Why Develop a Standard?

March, 2006

Why Develop a Standard?

- Eliminate the need for the Contractor to have or hire a Professional Engineer

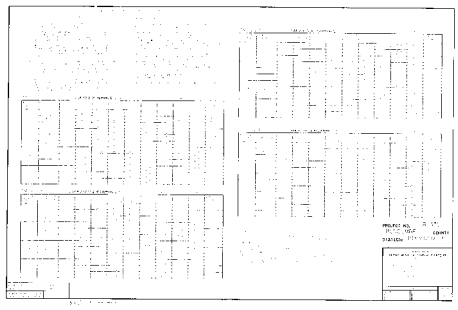
March, 2006

Structures Breakout

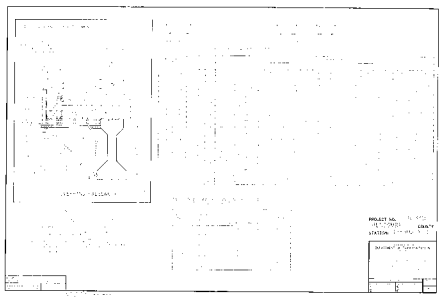
Why Develop a Standard?

- Eliminate the need for the Contractor to have or hire a Professional Engineer
- Reduce the amount of time needed for preparation and review of overhang submittals

March, 2006

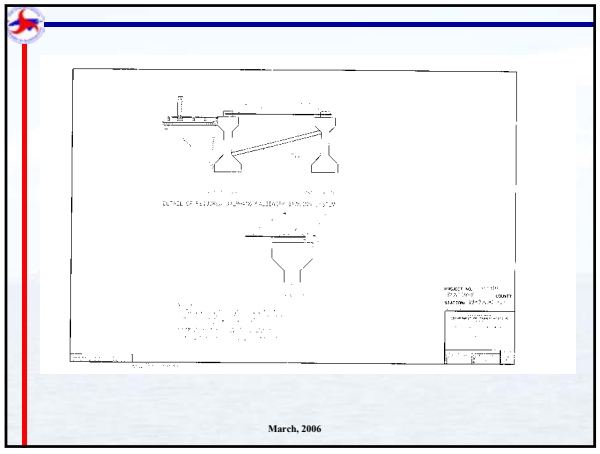


March, 2006

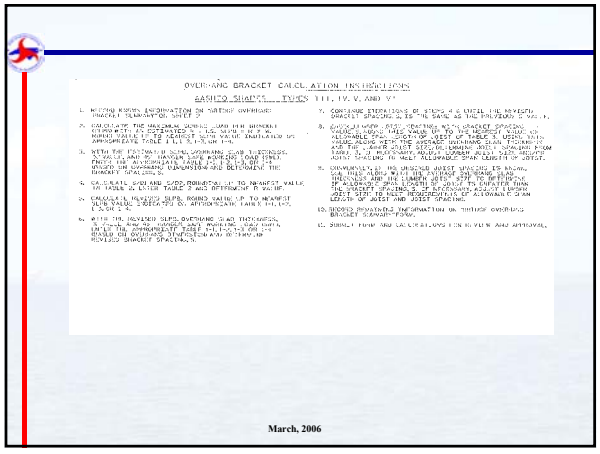


March, 2006

Structures Breakout

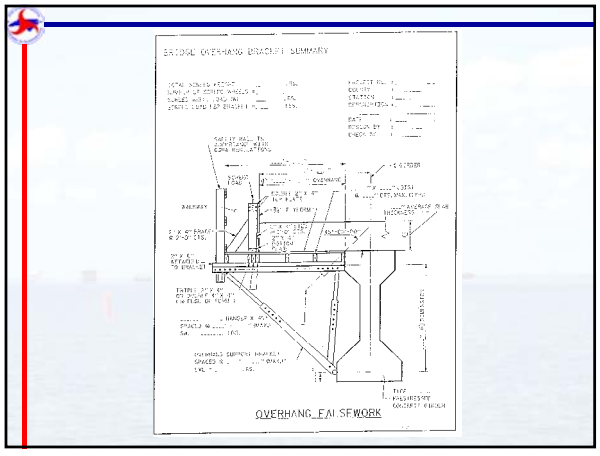


March, 2006



OVERHANG BRACKET CALCULATION INSTRUCTIONS

March, 2006



SIGNAL OVERHANG BRACKET SUMMARY

OVERHANG FALSEWORK

How is the standard working?

March, 2006

How is the standard working?

•To date, 35 projects containing the standard have been let

March, 2006

How is the standard working?

•To date, 35 projects containing the standard have been let
•The standard overhang design has been used on 26 of these projects

March, 2006

How is the standard working?

- To date, 35 projects containing the standard have been let
- The standard overhang design has been used on 26 of these projects
- The standard has been used almost 75% of the time

March, 2006

Where do we go from here?

March, 2006

Where do we go from here?

- Monitor usage of the standard

March, 2006


Where do we go from here?
•Monitor usage of the standard
•Develop standard for modified bulb tee's
March, 2006


Questions?


OPERATION
OF
CONSTRUCTION
EQUIPMENT
ON
BRIDGE DECKS

WHY WORRY ABOUT IT?

- VISIBLE DAMAGE TO DECK.
- INVISIBLE DAMAGE TO DECK AND GIRDERS.

SOUNDS LIKE COMMON SENSE??

- IF SO…
- WE MUST HAVE AN APPLICABLE SPECIFICATION.

March, 2006

ARTICLE 420-20

- PLACING LOAD ON STRUCTURE MEMBERS
- NEXT TO LAST PARAGRAPH:
  - "DO NOT PLACE CONSTRUCTION EQUIPMENT, MATERIALS, OR OTHER CONSTRUCTION LOADS ON ANY PART OF THE STRUCTURE WITHOUT PERMISSION. SUBMIT 7 COPIES OF THE PROPOSED PLANS FOR PLACING CONSTRUCTION LOADS ON THE STRUCTURE FOR REVIEW, COMMENTS, AND ACCEPTANCE."
-

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY, GOVERNOR — LYNDO TIPPETT, SECRETARY

November 15, 2004

MEMORANDUM TO: Division Engineers

FROM: E. C. Powell, Jr., P.E.
State Construction Engineer

SUBJECT: Operation of Construction Equipment on Bridges

Article 420-20 of the Standard Specifications requires contractors to submit for review and approval plans to operate on or cross a bridge deck with heavy equipment that is not legally allowed on a roadway. Examples of equipment that fall under this requirement include, but are not limited to, crawler cranes, truck cranes and concrete pumping trucks operating with outriggers down, scrapers, off-road dump trucks, automatically controlled fine grading machines, and concrete paving machines.

In administering this requirement the following review authority applies:

1. Structure Design Unit will review plans for bridges that have been or are being constructed under the contract.
2. Bridge Maintenance will review plans for existing bridges in or adjacent to the project that are open to public traffic.
3. The Designer of Record will review and accept plans for Detour Bridges on the project that have been designed by the Contractor or consultant working for the Contractor. In this case, the Contractor must provide a letter to the Resident Engineer from the Designer of Record indicating that the proposed plan is acceptable. Details of the proposed operation must be submitted and sealed by the Design Engineer of Record.
4. The Resident Engineer will review all proposals to cross bridges with construction equipment that can legally cross a bridge but may cause damage to the bridge deck and joints. This includes, but is not limited to, asphalt paving machines and steel wheel rollers.

In order to expedite the review, the following information should be obtained and submitted with the request:

- Make and model of the equipment including the manufacturer's catalog cuts
- General dimensions of the equipment, including width and length of tracks and spacing center to center of tracks or number and spacing of axles
- Weight of the equipment when traveling on the bridge including weight to be carried for individual axles
- Type of work being performed and weight of load to be lifted or carried by the equipment while on the bridge
- Size of construction mats to be used under the tracks or outriggers
- Spans that the equipment will be traveling on and exact locations on the spans
- Any other equipment, vehicles, or materials that will be on the span at the same time
- Proposed method for protecting joints or joint blockouts

Under no circumstances should heavy equipment be allowed on a bridge deck without prior approval. Upon completion of the work or crossing, both the contractor and the Department should inspect the deck and report any damage to the reviewing authority for further investigation.

Please direct any questions you have on this subject to the Bridge Construction Engineer for your Division.

ECP/tlj

cc: Mr. W. S. Varnedoe, P.E.
Mr. S. D. DeWitt, P.E.
Resident Engineers
Bridge Construction Engineers
Roadway Construction Engineers
Mr. Greg Perfetti, P.E.
Mr. John Emerson, P.E.

Structures Breakout

WHAT DO YOU NEED APPROVAL FOR??

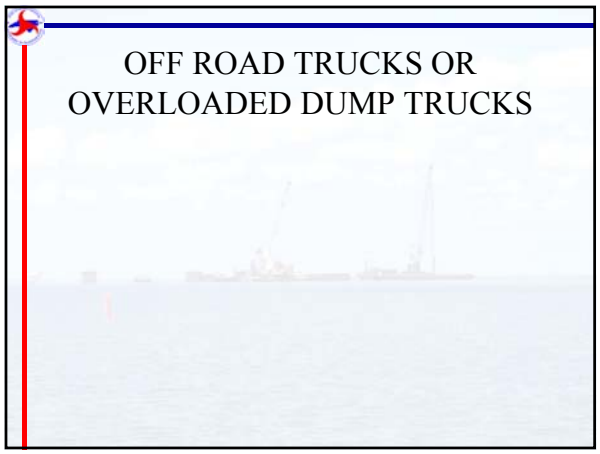
- ANYTHING THAT CAN NOT LEGALLY OPERATE ON AN OPEN ROADWAY BECAUSE OF WEIGHT.
- ANYTHING THAT PLACES A CONCENTRATED LOAD ON THE DECK.
- ANYTHING THAT YOU THINK COULD DAMAGE THE DECK.

INCLUDING:

- CRAWLER CRANE

TRUCK CRANE

Structures Breakout



FINE GRADING OR CONCRETE PAVING EQUIPMENT


MISCELLANEOUS


OTHERS?

- IF IN DOUBT, CONTACT YOUR EVER PLEASANT AND ALWAYS CHEERFUL BRIDGE CONSTRUCTION ENGINEER.

Structures Breakout

THE SUBMITTAL, WHERE DOES IT GO??

- STRUCTURE DESIGN UNIT
- BRIDGE MAINTENANCE UNIT
- DESIGNER OF RECORD FOR CONTRACTOR DESIGNED AND FURNISHED STRUCTURES
- RESIDENT ENGINEER

WHAT SHOULD THE SUBMITTAL INCLUDE?

- MAKE AND MODEL WITH CATALOGUE CUTS
- ALL DIMENSIONS THAT WILL CONTACT THE DECK
- ALL WEIGHTS, INCLUDING THE MATERIALS TO BE HANDLED
- WEIGHT DISTRIBUTION

WHAT SHOULD THE SUBMITTAL INCLUDE?

- PROPOSED PROTECTION SYSTEM FOR THE DECK
- EXACT LOCATION OF LOADS ON THE DECK AND RELATION TO GIRDER LINES AND BENTS
- ANY OTHER SUPPORT EQUIPMENT OR ANCILLARY MATERIALS THAT WILL LOAD THE DECK AT THE SAME TIME.

Structures Breakout